The Conduct of Science Practical for Working Adults in an ODL Setting

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Abstract

Laboratory practical play an important role in the teaching and learning of science and engineering courses. They are indispensable in elucidating and verifying the fundamental scientific principles taught in the class-room. By reinforcing the fundamental concepts and laws through laboratory experiments, practical sessions facilitate the learning process and widen the student's understanding of science and engineering. Achievement of scientific proficiency cannot be achieved without laboratory practical experience. Besides, they also promote critical skills such as report writing, data handling, and the ability to interpret and evaluate evidence.

In this paper, we review the science practical sessions for working adults in the context of open and distance learning. We share our experiences and discuss how the practical science sessions were conducted successfully nationwide to cater to the needs of adult learners enrolled in the Bachelor of Education (Science) programme at Open University Malaysia. Besides this, we will also elaborate on some of the pertinent issues and challenges that were faced in conducting these practical sessions over the last 8 years.

Introduction

Laboratory activities play an important role in teaching and learning science. Tobin, K.G (1990) concluded, that "laboratory activities appeal as a way to learn with understanding and, at the same time, engage in a process of constructing knowledge by doing science". The undisputable fact is that laboratory practical is able to promote the science education goals regardless of the topics learned. It encompasses a wide area of "hands on" laboratory skills with the equipments and chemicals employed and at the same time putting in practice the theoretical knowledge gained in the class-room. The values of science are diminished if the students are unable to explore the subject via laboratory practical experiments. The process of sharpening the practical skills can only be done through actual laboratory practical. According to Kerr (1963), there are many aims of laboratory practical work. Some of them are to encourage accurate observations and careful reasoning, promote simple, common sense, scientific methods of thought, to

verify scientific, and to maintain interest in science subjects. Laboratory practical also enable students to plan and involve themselves in various activities such as observing, classifying, collecting data, explaining, and experiment. Thus the laboratory practical method is able to provide an excellent learning experience for the adult students engaged in science subjects. In this paper, we will share our experience in conducting laboratory practical in OUM mode.

Open and Distance Learning Programme in OUM

The Open University Malaysia is an open distance learning institution with an enrolment of over 100,000 learners spread over 60 learning centres throughout Malaysian. The university consists of Faculty of Business & Management, Faculty of Education & Languages, Faculty of Applied and Social Science, Faculty of Information Technology & Multimedia Communication and Faculty of Science and Technology. There is a Centre for Graduate Studies and an Institute of Professional Development which operates from the mains campus. At present it offers 34 undergraduate courses and 13 post graduate courses.

ODL providers tend to blend their learning approach to suit the needs of its adult learners. The widespread blended learning encompasses some face-to-face tutorial sessions, self-managed learning and e-learning or online learning that is facilitated by an online Virtual Learning Environment (VLE). The online learning component largely requires learners to go into online forums for discussions with each other and with the tutor on pre-determined topics. There is also a take home assignment and compulsory practical session conducted during vigilantly scheduled sessions and one final exam conducted under strict supervision. It should also be noted that in any open and distance learning environment; students have limited face-to-face contact with their tutors.

In 2002, OUM developed a B.Ed (Sc) programme, offered by the Faculty of Science and Technology that catered specifically to schoolteachers. Their studies were funded by the government as part of a continuous effort to increase the number of graduate teachers in the primary and secondary schools. The students who enrolled in this programme comprised of government primary school and lower secondary school teachers who were distributed throughout the country. Between 2002 to 2010, OUM successfully trained huge number of school teachers who is currently attached to the same school with improved qualification.

These school teachers fit the typical adult learner profile: they tend to be older in age, hold full-time jobs, have families to look after and are often found to be juggling with time as they try to cope with their studies and various other commitments. Time is always a crucial factor for them to excel in future undertakings. The struggle to advance their studies in conventional higher learning centre is not viable. These adult learners will be eyeing for an opportunity that suits their needs and able to provide the relevant education experience considering their current scenario. Since the B. Ed (Sc) programme is able to furnish their knowledge and fulfill their dreams in current profession, they are obliged to complete the B. Ed (Sc) programe layout which requires them to fulfill the elements of theoretical and practical knowledge.

B. Ed (Sc) programme in OUM

The B. Ed (Sc) programme consists of core science courses such as chemistry, physics and biology. There is a mandatory laboratory component for these courses. OUM believes in providing "hands-on" laboratory practical sessions for students to strengthen their understanding on what they had read from their modules. It is the responsibility of the university to provide space for their students to develop their practical skills.

Considering the challenges and the cost involved in setting up fully equipped laboratory to conduct practical sessions, very few ODL providers actually embark in science degree courses. However, OUM went ahead and offered the B.Ed (Sc) programme without compromising on the quality of the laboratory practical. OUM has vigilantly planned and executed the laboratory practical successfully since 2003. It is a mandatory requirement of Malaysia Qualification Agency (MQA) that insists on laboratory practical for science courses.

The readiness in offer science based courses in the Faculty of Science and Engineering became a lurid experience considering the forthcoming concerns regarding the compulsory laboratory sessions. However, the university cautiously planned practical activity as a compulsory agenda for the science based courses as a milestone achievement towards the development of the Science and Engineering Faculty. The practical for science courses had been a great challenge for the university knowing the obstacle are at large. However, bearing in mind on the rigorousness of the science practical activity, the team of Academics and Dean drafted a plan with the University Policy Makers.

The teaching and learning science practical that OUM practices is based on the core principles which determine the success of the university in offering science based courses. According to the OUM module, Practical Activity in Science, SBSC 3203, the practical activities that OUM initiated in ODL setting remain on core laboratory objectives as shown below:

(i) Science practical will allow the students to comprehend complex concepts concretely.

(ii) Science practical helps students to build necessary skills that a science student should attain. The skills can only be learned through practical.

(iii) Science practical able to motivate students to further explore scientific knowledge and promotes higher level of scientific learning.

(iv) Science practical disseminate the students with laboratory setting and give them an opportunity to intermingle with the scientific apparatus, instrumentation and equipments.

(v) Science practical allows students to experiment the inquiry-discovery and problem solving approach which was learnt.

The OUM Laboratory Session

Catering working adults with core science subjects served with laboratory practical has never been easy. The students are distributed all over the country and conducting a centralized laboratory session at OUM is not feasible. Furthermore, the major population of OUM students is mainly teachers who need take day off in order to attend practical in main campus. They are not being able to put their job responsibilities at stake. As an ODL provider, it is the scope of the OUM to cater these students with appropriate learning opportunities.

In addition, OUM does not have the facilities in terms of space and laboratory equipments. In setting a proper laboratory, space and equipments are the major concerns in order to provide the best learning environment for the students. In chemistry for example, chemical storage is a safety issue that needs to be handled by trained personnel. Maintaining laboratory equipments and managing the laboratories incur cost and is not practicable in the long run.

However exposing students in a "hands-on" laboratory environment is fundamental in the learning of science. Practical work has become crucial in enhancing students' ability to learn, conduct and understand experiments which is predetermined by a science teacher. They also have the potential to transform students to become active learners, rather than as passive end users of unpalatable textbook knowledge. Furthermore, laboratory practical are invaluable in demystifying key concepts; the hand on demonstration helps clarify concepts that might otherwise be unclear to the learner. As a result, students acquire vital process skills and deepen their understanding and appreciation of science

Bearing this in mind, OUM decided to run the practical sessions by using external laboratories at various locations throughout the country. These laboratories, which are fully equipped, belong to private and public universities. Centers and are rented out by OUM when laboratory sessions need to be conducted. The students are required to attend their practical sessions.

At each of these rented laboratories, a laboratory coordinator oversees the running of the laboratory practical for OUM. The laboratory coordinator is appointed by the respective university/department head to liaise with OUM on practical matters. All laboratory coordinators are briefed by the faculty on the student number at that particular laboratory center, the apparatus and chemicals needed and the experiments to be conducted. They are also told of the criteria to be used in grading the laboratory reports

The laboratory coordinator is responsible to plan, manage and coordinate the practical sessions for OUM at his laboratory center.. He is also required to ensure that they are sufficient laboratory demonstrators at each laboratory center to assist students and to ensure the smooth running of the practical sessions, the demonstrators also help out in grading the laboratory reports. Each demonstrator handles approximately 25 students. The pre-agreed claim payment will be made are inclusive of laboratory rent, consumables, laboratory coordinator, demonstrator, laboratory technician and laboratory report marking.

Each laboratory sessions are conducted for two sessions (two days) on any scheduled weekend. Students need to attend both days and complete 5-6 experiments. Each experiment can be completed within two hours and three experiments are completed per day (approx 6-8 hours). Students are given a week to complete their laboratory reports, which are graded by the laboratory coordinator. Laboratory reports contribute to 10-15 % of the final grade for science courses which have a laboratory component

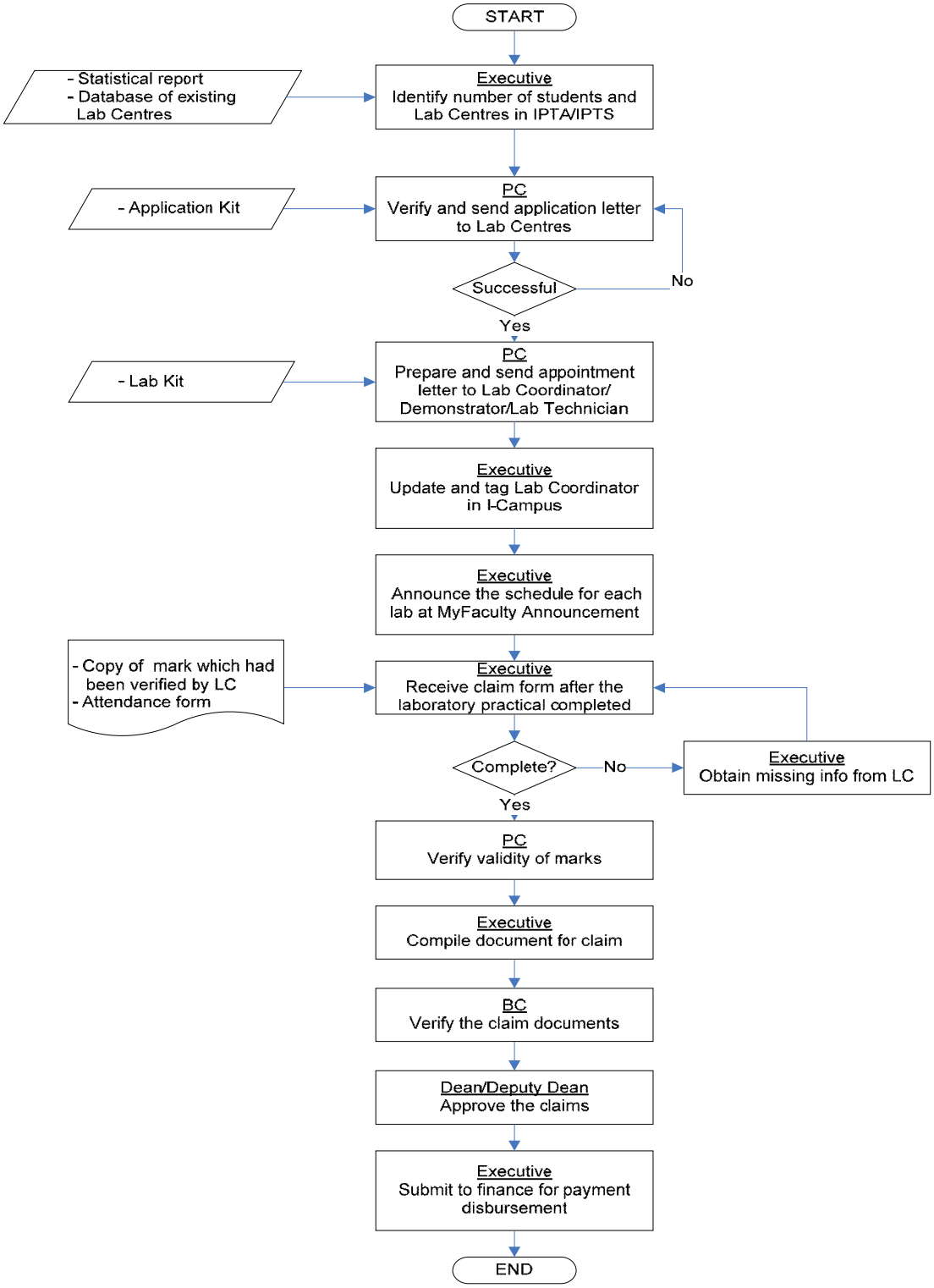
Laboratory Procedures in OUM

In order to ensure the practical sessions over a particular semester are carried out smoothly, OUM over the years have outlined a set of standard operating procedures which provided the basis for laboratory centers identifications and managements. The process would be initiated with the executives referring to the Statistical Report from I-Campus to identify courses which are to be offered on the coming semester together with number of students registered for the said courses. Subsequently, the executive would also refer to the available database to determine the available laboratory centers in IPTA as well as IPTS, in which the Programme Coordinator upon verification would be sending application letter together with Application Kit to the IPTA/IPTS identified by the faculty.

Once the approval has been obtained from the IPTA/IPTS, Programme Coordinator would then be sending the prepared Laboratory Kit attached with the appointment letter to concerned Laboratory Coordinator/Demonstrator/Laboratory Technician, as the executive updates and tags the Laboratory Coordinators in I-Campus before proceeding to inform and upload the laboratory schedules through MyFaculty Announcement. Executive would then be receiving the completed claim forms upon the completion of the laboratory practical session, where, in the event of incomplete form was submitted, the executive would try to obtain the missing information from the Learning Centers.

After that the Programme Coordinator would be verifying the validity of the marks obtained by the students while the executive compiles all related documents for claims before being verified by Budget Coordinator on the claim forms and documents. The final step would be the claim approvals by the Dean of the faculty. The processes are given in the flow chart below:

Management Of Laboratory Practicals



Practical Issues

Below are a couple of major issues that we have encountered in running the laboratory practical.

5.1- Scheduling

School teachers enrolled in the BSC(Ed) programme hold full-time jobs, have families to look after and are often found to be juggling with time as they try to cope with their studies and various other commitments. They also attend tutorials over certain weekends. Thus, the scheduling of practical dates are always planned in advance to avoid any disruption to the tutorial sessions. However, there are times when dates have to reschedule. There could be a school related event that the teachers have to attend or a development at the laboratory center that does not permit practical to be conducted on that date. To minimize inconvenience to the learner, the laboratory dates have to be shifted to another weekend or conducted just after the final. But from our experience, rescheduling rarely happens as the faculty takes the initiative to find out from students and the laboratories whether the chosen dates are suitable or not.

5.2 - Location of Laboratory Centers

The university tries its best to accommodate students' by locating laboratories as near as possible to the various learning centers. This, however, is not always possible, particularly in East Malaysia. Here, students from small towns have to travel to the nearest laboratory centers that are located either in Kuching or in Kota Kinabalu. Depending where they are, the distance to these laboratory could be anywhere between 400-800 km. But thanks to the availability of budget flights in Malaysia, air travel has been become the most convenient option for students. They need not worry anymore about long and tiresome journeys by bus, or by car to reach these laboratory centers. Since the laboratory schedule is announced at least a month before the laboratory sessions, students are able to purchase their air tickets at even lower prices.

Conclusion

Laboratory practical are considered as valuable tools in maximizing the learning experiences of adults. It enhances and emphasizes critical thinking, problem solving and scientific enquiries. Open University Malaysia (OUM) has developed a practical mode which stress on the integration of the acquisition and application of scientific knowledge. The succession of the practical model has upheld scientific skills and enquiring attitude among the adult students inline with the ODL philosophy. From our experience, degree courses in science via distance learning can be offered without jettisoning the practical sessions. To this end, laboratory can be rented at suitable locations to conduct practical sessions with the aid of external manpower.

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